INTERNATIONAL JOURNAL ON ECONOMICS, FINANCE AND SUSTAINABLE DEVELOPMENT

IJEFSD

Available online at www.researchparks.org

RESEARCH PARK

Journal homepage: www.researchparks.org/

IMPACT OF COVID-19 ON AIR QUALITY: EVIDENCE FROM THE TEN MAJOR CITIES WORLD WIDE

Dr. Sugandha Chhibber

Assistant Professor, Dept of Commerce GGDSD College, Kheri Gurna Banur

(Email Id: sugandha.chhibber@gmail.com), (Mobile No: 9872888394)

A B S T R A C T

Air pollution constitutes the most pressing environmental health risk facing our global population. It is estimated to contribute toward 7 million premature deaths a year, while 92% of the world's population is estimated to breathe toxic air quality (WHO, 2016). In less developed countries, 98% of children under five breathe toxic air. As a result, air pollution is the main cause of death for children under the age of 15, killing 600,000 every year (WHO, 2018). In financial terms, premature deaths due to air pollution cost about $5 trillion in welfare losses worldwide (The World Bank, 2016). Worldwide ambient air pollution accounts for 29% of all deaths and disease from lung cancer, 17% of all deaths and disease from acute lower respiratory infection, 24% of all deaths from stroke, 25% of all deaths and disease from ischaemic heart disease, 43% of all deaths and disease from chronic obstructive pulmonary disease. But despite this, the awareness regarding air pollution has remained low in the areas where real time monitoring is limited but pollution level may be high. But Corona virus pandemic has bought dramatic change into air quality. Since the lockdown was implemented in response to the deadly Corona virus pandemic, the dramatic changes brought about by these restrictions have been described as the 'largest scale experiment ever' into air quality. In many places, the halt of movement and industry has shown a glimpse of a cleaner world, with many reports of exceptional blue skies. On the 50th anniversary of the earth day, a positive change climate change and decrease in air level of pollution was witnessed. In this paper, the impact of COVID-19 on society and global environment has been discussed. The current study aimed to analyze levels of PM2.5 reported by ground-level monitoring stations in 10 major global cities. Further, studied aimed to compare measurements of the world's deadliest air pollutant, fine particulate matter (PM2.5), and prior to and during the pandemic in 10 major global cities under lockdown: The 10 major global cities includes Delhi, London, Los Angeles, Milan, Mumbai, New York City, Rome, São Paulo, Seoul and Wuhan. Findings revealed a drastic drop in PM2.5 pollution for most global locations under lockdown conditions.

Click here and insert your abstract text.

A R T I C L E I N F O

Article history:
Received 20 May 2020
Received in revised form 15 June 2020
Accepted 23 June 2020

Keywords:
Covid-19, PM2.5 levels, Lockdown Measures, Air Quality Index

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.
ISSN (electronic): 2620-6269/ ISSN (printed): 2615-4021 . Hosting by Research Parks All rights reserved.

INRODUCTION

The COVID-19 pandemic is considered as the most crucial global health calamity of the century and the greatest challenge that the humankind faced since the 2nd World War. In December 2019, a new infectious respiratory disease emerged in Wuhan, Hubei province, China and was named by the World Health Organization as COVID-19 (corona virus disease 2019). A new class of corona virus, known as SARS-CoV-2 (severe acute respiratory syndrome corona virus 2) has been found to be responsible for occurrence of this disease. As far as the history of human civilization is concerned there are instances of severe outbreaks of diseases caused by a number of viruses. According to the report of the World Health Organization (WHO as of April 18 2020), the current outbreak of COVID-19, has affected over 2164111 people and killed more than 146,198 people in more than 200 countries throughout the world. Till now there is no report of any clinically approved antiviral drugs or vaccines that are effective against COVID-19. It has rapidly spread around the world, posing enormous health, economic, environmental and social challenges to the entire human population. The corona virus outbreak is severely disrupting the global economy. Almost all the nations are struggling to slow down the transmission of the disease by testing & treating patients, quarantining suspected persons through contact tracing, restricting large gatherings, maintaining complete or partial lock down etc.

Air pollution constitutes the most pressing environmental health risk facing our global population. It is estimated to contribute toward 7 million premature deaths a year, while 92% of the world's population is estimated to breathe toxic air quality (WHO, 2016). In less developed countries, 98% of children under five breathe toxic air. As a result, air pollution is the main cause of death for children under the age of 15, killing 600,000 every year (WHO, 2018). In financial terms, premature deaths due to air pollution cost about $5 trillion in welfare losses worldwide (The World Bank, 2016). Worldwide ambient air pollution accounts for 29% of all deaths and disease from lung cancer, 17% of all deaths and disease from acute lower respiratory infection, 24% of all deaths from stroke, 25% of all deaths and disease from ischaemic heart disease, 43% of all deaths and disease from chronic obstructive pulmonary disease.

But despite this awareness regarding air pollution has remained low in the areas where real time monitoring is limited but pollution level may be high. But Corona virus pandemic has bought dramatic change into air quality. Since the lockdown was implemented in response to the deadly Corona virus pandemic, the dramatic changes brought about by these restrictions have been described as the 'largest scale experiment ever' into air quality. In many places, the halt of movement and industry has shown a glimpse of a cleaner world, with many reports of exceptional blue skies.

REVIEW OF LITERATURE

Epidemiologists have started to investigate possible environmental factors that accelerate the spread of SARS-CoV-2 within communities (Sajadi *et al.,* 2020; Bhattacharjee, 2020). A recent paper by van Doremalen *et al.* (2020) analyzed the aerosol and surface stability of SARS-CoV-2 and compared it with SARS-CoV-1, the most closely related human coronavirus (Wu *et al.,* 2020a). The study found that SARS-CoV-2 can survive up to three days on some surfaces, like plastic and steel, and that aerosol transmission is plausible since the virus can remain viable and infectious in the air for hours. These findings echo those of Chen *et al.* (2004) on environmental contamination with SARS-CoV-1, and are consistent with evidence for aerosol distribution of SARS-CoV-2 found by Guo *et al.* (2020), but are inconsistent with the current WHO stance that SARS-CoV-2 is not transported by air. However, the possibility of airborne transmission would call for different mitigation efforts to prevent spreading and is thus an important area of study. The risk of infection of some airborne viruses has been shown to increase in the presence of ambient fine particles that can stay in the air for long periods, travel far distances, and penetrate deeply into lungs.1 One highly contagious airborne disease is caused by the measles virus. Previous studies on disease outbreaks have highlighted that the incidence of measles in China increased 1-3 days after short-term exposure to high concentrations of PM10 and SO2 Chen et al. (2017b); Peng *et al.* (2020). In another study, ambient fine particles were found to contribute to the relative risk of influenza transmission in Chinese cities (Chen et al., 2017a) with the most significant effect occurring within a period of 2-3 days. If air pollution plays a similar role in the incidence of SARS-CoV-2, there should be a positive relationship between confirmed COVID-19 cases and particulate matter concentrations. China ranks among the worst globally in terms of PM2.5 concentrations and, within China, the Hubei province is among the more heavily polluted areas (van Donkelaar *et al.,* 2016). The most heavily hit Italian region is the Lombardy area in the northern Po valley, which is among the regions with the worst air quality in Europe. Preliminary findings from Italian researchers started pointing towards a correlation between days of exceeding the limits for PM10 and the number of hospital admissions from COVID-19 (Setti *et al.,* 2020; Onufrio, 2020). Increased air pollution could just reflect the presence of anthropogenic activity which instead

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.
ISSN (electronic): 2620-6269/ ISSN (printed): 2615-4021

explains the patterns. However, that does not explain why COVID-19 cases are not increasing rapidly in every densely populated area.

OBJECTIVE OF THE STUDY

To investigate this further, the current contemporary study aims to:

- To analyzes levels of PM2.5 reported by ground-level monitoring stations in 10 major global cities.

RESEARCH METHODOLOGY

a) Source of information**:** The present study is mainly based on secondary data.

- **Main source of data** includes Hourly PM2.5 readings recorded by 7 governmental agencies (the U.S. State Department, China National Environment Monitoring Center, European Environment Agency, Seoul Metropolitan Government, Companhia Ambiental do Estado de São Paulo, and Ayuntamiento de Madrid.)
- **Supplemental data** has been obtained from validated non-govern- mental air quality monitoring stations.
- All locations and their data sources are visible on the IQAir AirVisual app and website: https://www.iqair.com/air-quality-map.
- Further to supplement the data different publications, various books, journals and different websites related to Covid 19 have been used for better reliability.

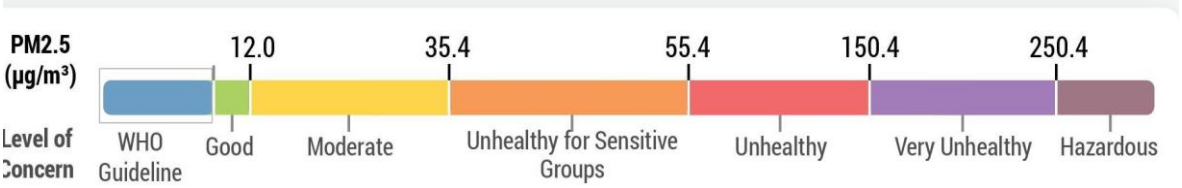
b) **Period of the study** is 3 weeks period for each city during lockdown conditions, and compared this to the same period in 2019, 2018, 2017 and 2016.

- **Main reason behind choosing the same time period across different years was,** because air pollution levels often vary greatly with seasonal changes in weather and other conditions.
- The 3-week timeframe has been selected for each city to reflect either the period when the most stringent lockdown measures were in place or, during longer lockdown periods such as in Wuhan, to coincide with the 'peak' of daily reported COVID-19 cases.

c) **Sample size:** The 10 major global cities include Delhi, London, Los Angeles, Milan, Mumbai, New York City, Rome, São Paulo, Seoul and Wuhan. Findings revealed a drastic drop in PM2.5 pollution for most global locations under lockdown conditions.

d) **Basis for Selecting of Sample Cities** was on the extent of lockdown measures and the number of Coronavirus cases relative to other cities in the same country.

e) **Representation of Data:** In order to correlate concentration values to a more relatable reference for health risk, this report uses the US EPA standard color index, supplemented by the WHO annual mean exposure threshold of 10 µg/m³.1,2



The methodology and data representation strives to highlight the effects of the COVID-19 lockdowns on a wide variety of cities with different air quality challenges.

Before moving further we need to know about three terms i.e. **PM2.5, IQ Air & Air Visual**

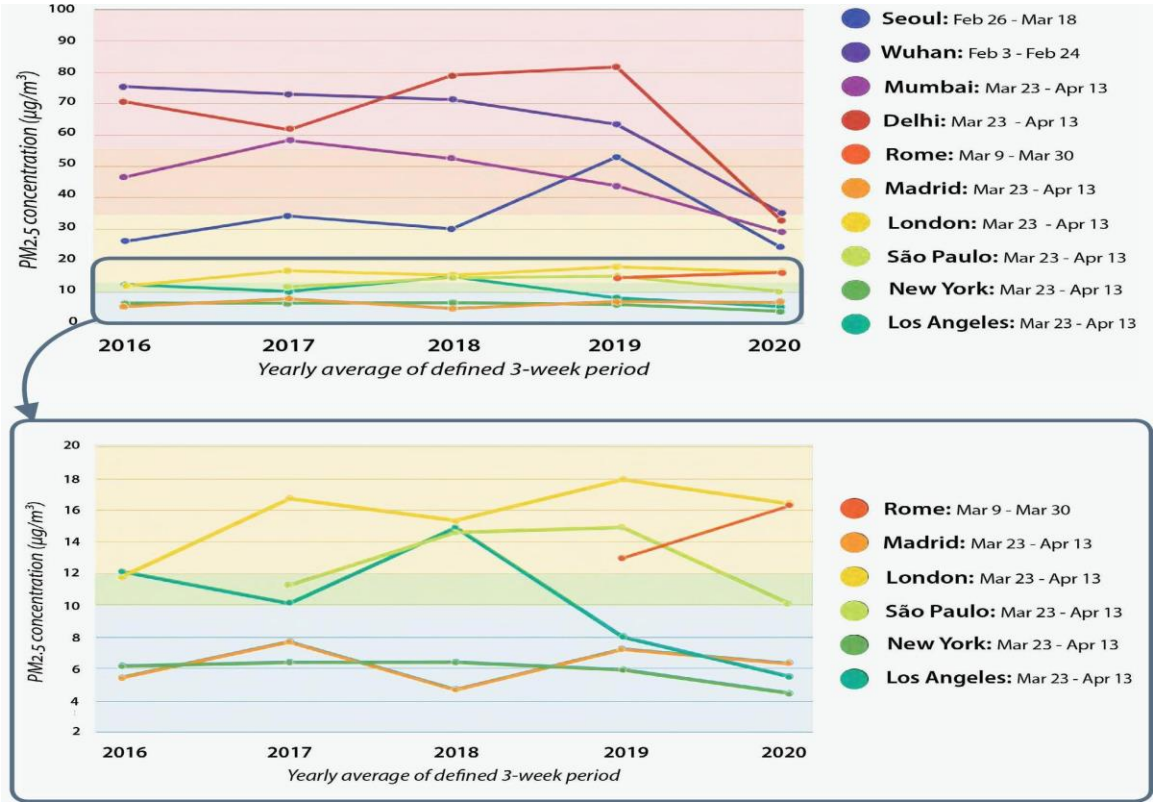
- **PM2.5** (Particulate matter with a diameter of 2.5 micrometers or less) is widely regarded as the pollutant that poses the greatest threat to health of all commonly measured air pollutants. Due to its small size, PM2.5 is able to penetrate deep into the human respiratory system and into the blood stream, potentially causing a wide range of short- and long-term health effects. For more information, go to https://www.iqair.com/blog/air-quality/pm2-5
- **IQ Air** is a Swiss-based air quality technology company that empowers the world to breathe cleaner air through information, collaboration and technology solutions. With the vision of a world where everyone breathes clean air, IQ Air provides individuals, organizations and communities with tools to improve air quality. Since 1963, IQ Air has pioneered air quality solutions that include air quality data, sensors, monitoring systems, air purification and expert services.

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.
ISSN (electronic): 2620-6269/ ISSN (printed): 2615-4021

- **Air Visual** is IQ Air's air quality data platform, which offers the world's largest set of real-time and historical global air quality data. The platform processes billions of data points each day, reporting from a range of sources in- cluding government monitoring stations, satellite data and privately-operated low-cost monitors.

RESULTS AND INTERPRETATION

According to the study results showed that cities with historically higher levels of PM2.5 pollution witnessed the most substantial drops, including Delhi (-60%), Seoul (-54%) and Wuhan (-44%). While all cities demonstrated a drop in PM2.5 levels during lockdown conditions when compared to 2019, cities with historically higher PM2.5 concentration levels, such as Delhi, Mumbai, and Wuhan, showed the most dramatic reductions in PM2.5. Graph 1: Yearly PM2.5 levels over defined 3-week period for selected major cities.



Graph 1: Yearly PM2.5 levels over defined 3-week period for selected major cities

- **CITIES WISE RESULTS AND INTERPRETATION**

DATA ANLAYSIS OF WUHAN (CHINA)

Results showed that Wuhan saw a 50% reduction in PM2.5 during the 2020 COVID-19 lockdown, as compared to the previous 4-year period average.

LOCKDOWN MEASURES

Wuhan, the epicenter of the original novel coronavirus outbreak, had some of the highest numbers of reported COVID-19 cases globally. In response to a surge of cases and deaths, the Chinese government ordered its highest Class 1 Response for public health emergencies on January 24.1 Wuhan's lockdown directives on its 11 million residents were the most stringent and long-lasting of anywhere globally. After 10 weeks of far-reaching mitigation efforts, the city's lockdown was finally lifted on April 8.2

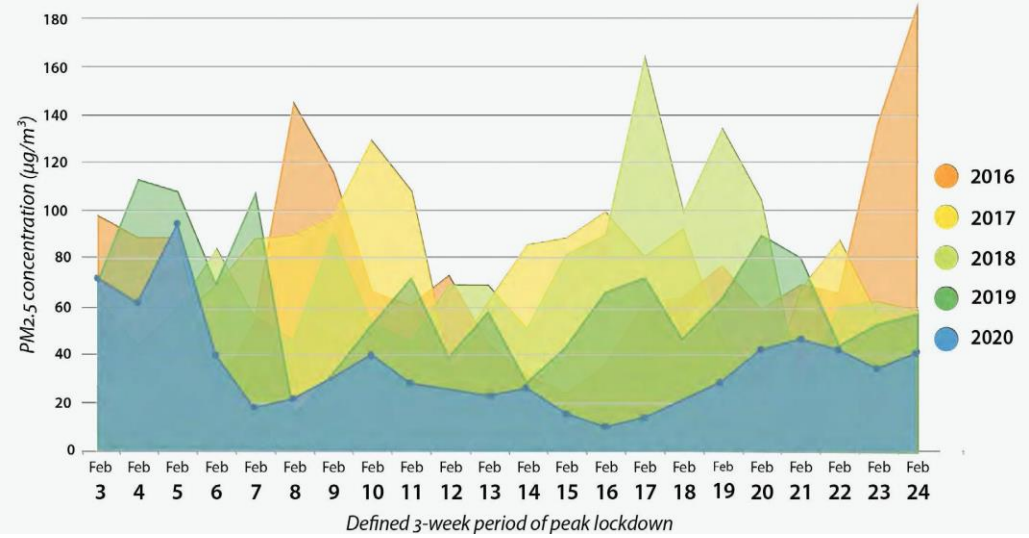
Wuhan's lockdown measures included barring private vehicle movement, a suspension of most public transport, school closures, and the shutdown of all non-essential businesses.3,4 Some areas restricted outings to one family

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.
ISSN (electronic): 2620-6269/ ISSN (printed): 2615-4021

member every other day to buy necessities. Areas under containment barred residents from leaving, requiring them to order in food and other supplies from delivery services. IMPACT ON PM2.5 Over the course of Wuhan's full 10-week lockdown, the city experienced its cleanest air quality on record for the months of February and March, with average PM2.5 concentrations (μg/m³) of 36.8 and 32.9 respectively. For context, February and March 2019 averaged PM2.5 concentrations of 63.2 and 43.9 respectively.

Graph 2: Daily PM2.5 levels in Wuhan from 2016-2020, indicated by US AQI color (Source: http://china.caixin.com/2020-01-29/101509411.html)

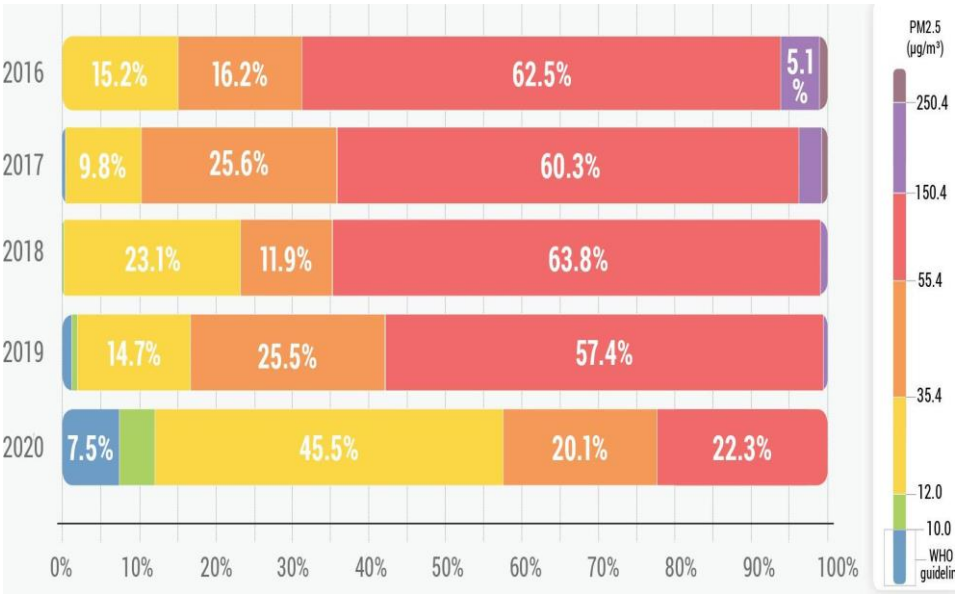
During the defined 3-week peak lockdown period, PM2.5 levels in Wuhan were slashed to half the average of the prior 4 years, and were down 44% from 2019. The smaller decrease since 2019 indicates the Chinese government's ongoing efforts to reduce air pollution across major Chinese cities year-on-year.



Graph 3: Daily PM2.5 levels in Wuhan from 2016-2020 (Feb 3 - Feb 24)

During the past 4 years, between February 3 and February 24, 50-60% of hours qualified as "unhealthy" or "very unhealthy" according to the US Air Quality Index (AQI).1,2 For the same period in 2020, only 22% of hours were classified as US AQI "unhealthy". Moreover, 2020's period had 7.5% of hours meet the stringent WHO target for PM2.5 levels **(<10 μg/m³), up from only 1.2% in 2019, and 0% in 2018.**[3]

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.
ISSN (electronic): 2620-6269/ ISSN (printed): 2615-4021 . Hosting by Research Parks



Graph 4: Wuhan's distribution of hourly PM2.5 concentrations from Feb 3 - Feb 24, shown as US Air Quality Index categories

(**Source:** 1. The US AQI designation for PM2.5 concentration levels between 55.0 µg/m³ and 150.4 µg/m³
2. The US AQI designation for PM2.5 concentration levels between 150.4 µg/m³ and 250.4 µg/m³.
3. https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health)

DATA ANLAYSIS OF WUHAN INDIA

Results showed that Delhi's 'unhealthy' and worse rated days plummeted from 68% in 2019 to 17% during lockdown.

LOCKDOWN MEASURES

India Prime Minister Narendra Modi ordered the world's largest lockdown on March 25, affecting everyone of its 1.3 billion residents.1 The lockdown, initially framed to last 21 days, was extended on April 11 for an additional 2 weeks.2 Mandates of the previous lockdown, effective until April 15, and then relaxed, included: sealed borders, curfews and restrictions on movement to only essential outings such as for food and health care. Containment areas in major cities (381 in Mumbai; 30 in Delhi) added additional restrictions - mandating no movement outdoors, thus forbidding grocery purchases and restaurant delivery.3

IMPACT ON PM2.5

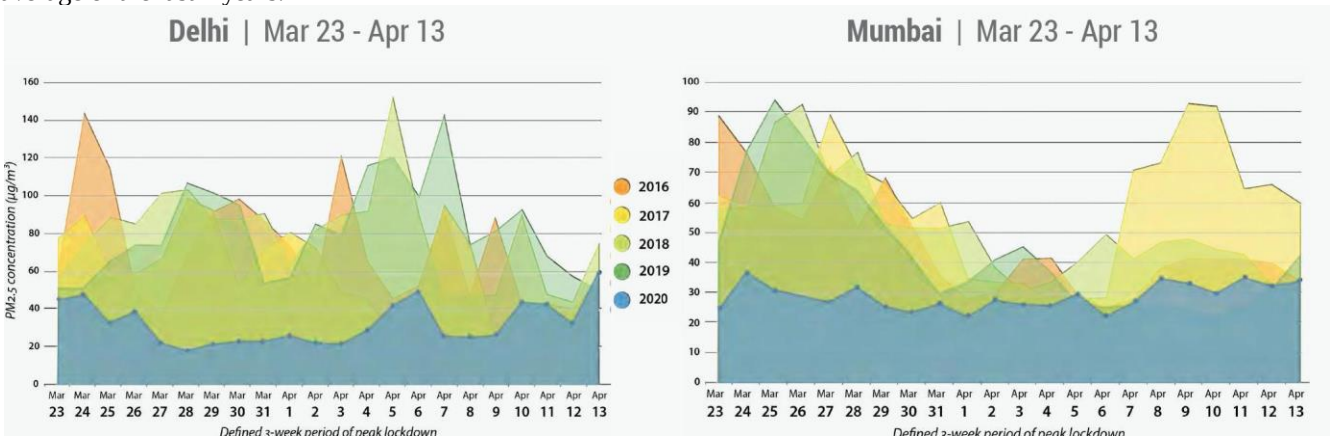
India is among the most polluted countries globally. An average resident is exposed to air pollution that exceeds the WHO target for annual PM2.5 exposure by more than 500%.4 Recent government-mandated lockdowns in response to climbing COVID-19 cases have shuttered businesses, eliminated traffic congestion, and paused construction projects and non-essential industry. The dramatic impact seen on air quality reflects the sheer scale of India's average air pollution emissions. Both Delhi and Mumbai experienced their best March air quality on record in 2020 (49.8 µg/m³ and 34.5 µg/m³ PM2.5 respectively), while April 2020 is also on track to be the best April on record, should the current trends continue. Graph 5: Daily PM2.5 levels in Delhi from 2016-2020, indicated by US AQI color

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.
ISSN (electronic): 2620-6269/ ISSN (printed): 2615-4021 . Hosting by Research Parks

Graph 5: Daily PM2.5 levels in Delhi from 2016-2020, indicated by US AQI color

(**Source:** 1.https://economictimes.indiatimes.com/news/politics-and-nation/india-will-be-under-complete-lockdown-starting-midnight-narendra-modi/articleshow/74796908.cms?from=md)
2.http://timesofindia.indiatimes.com/articleshow/75075290.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
3.http://timesofindia.indiatimes.com/articleshow/75075290.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
4 According to IQAir's 2019 World Air Quality Report)

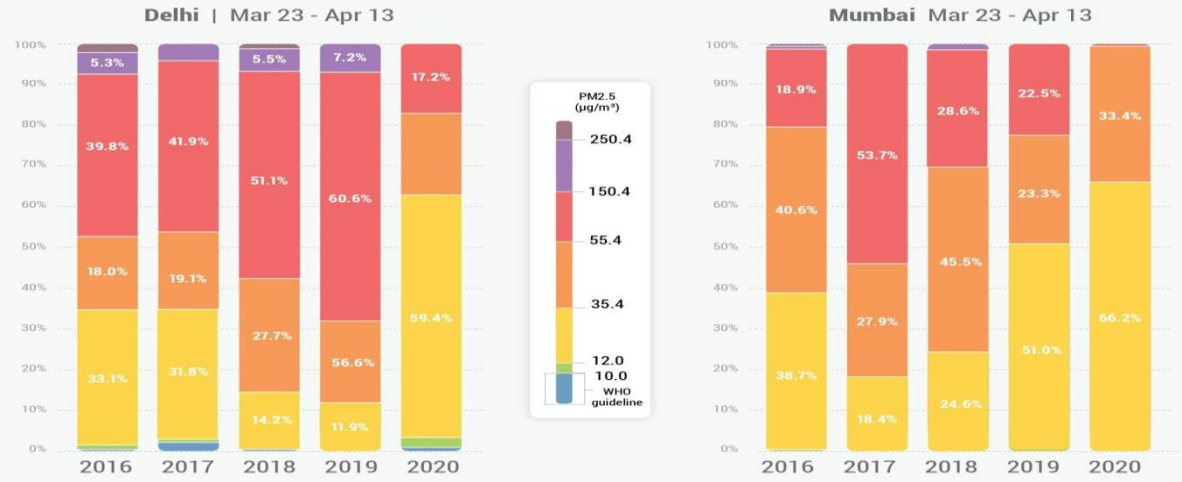
Results showed that in Delhi, PM2.5 concentration levels are down by 60% from the same time last year, and down 55% from the average of the prior 4 years. In Mumbai, PM2.5 levels are down 34% from 2019, and 43% from the average of the last 4 years.



Graph 6: Daily PM2.5 levels in Delhi and Mumbai from 2016-2020, during the 2020 lockdown period (Mar 23 - Apr 13)

During the 3-week lockdown period, Delhi's air quality rated as 'unhealthy' and worse dropped from 68% in 2019 to 17% in 2020 - while 3% of hours experienced "good" US AQI air quality, up from 0% in 2019. Mumbai observed a drop in 'unhealthy' air quality hours from 22.5% to 0.4%.

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.
ISSN (electronic): 2620-6269/ ISSN (printed): 2615-4021



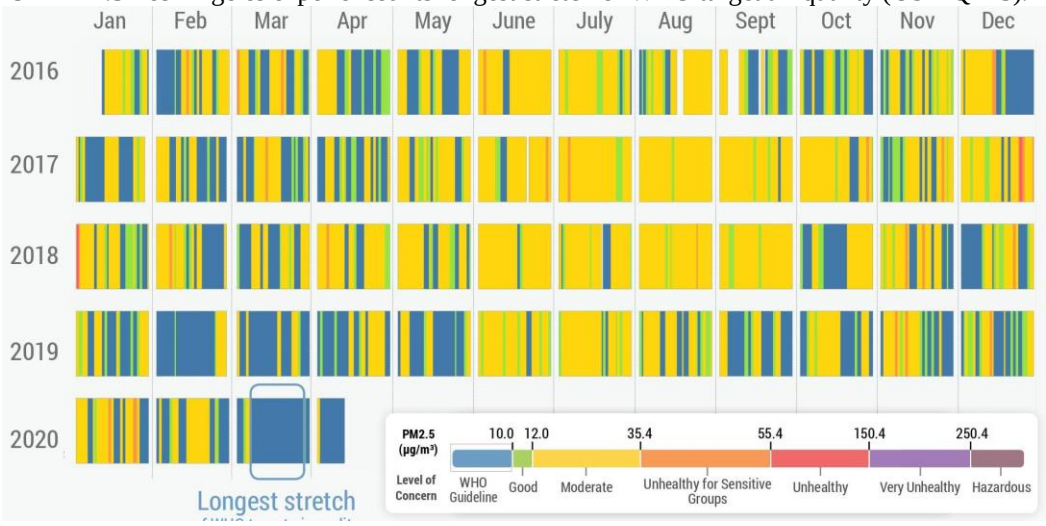
Graph 7: Delhi and Mumbai's distribution of hourly PM2.5 concentrations from Mar 23 - Apr 13, shown as US Air Quality Index categories

DATA ANLAYSIS OF UN ITED STATES

Results showed that Los Angeles experienced its longest stretch of clean air on record meeting WHO guidelines

LOCKDOWN MEASURES

In the US, states and municipalities have been responsible for ordering measures to slow the spread of COVID-19. California, the country's most populous state, was the first in the US to issue a mandatory lockdown among its 40 million residents on March 20.1 The directive ordered the closure of all non-essential services, banned social gatherings public and private, and encouraged residents to stay-at-home unless enjoying solitary outdoor activities. While responses across the 50 states have varied, the majority have followed suit in upholding similar orders as California. New York State, the current epicenter of the US outbreak, went into lockdown on March 23.2 IMPACT ON PM2.5 Los Angeles experienced its longest stretch of WHO target air quality (US AQI 23).

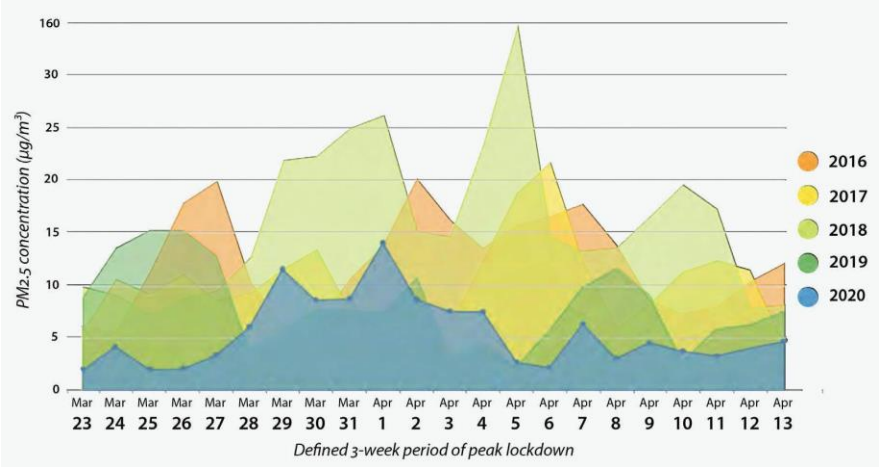


Graph 8: Daily PM2.5 levels in Los Angeles from 2016-2020, indicated by US AQI color

(Source: 1. https://www.wsj.com/articles/china-reports-no-new-domestic-coronavirus-infections-for-the-first-time-since-outbreak-started-11584611233 2. https://www.wsj.com/articles/new-york-gov-cuomo-orders-all-nonessential-workers-in-state-to-stay-home-11584718223

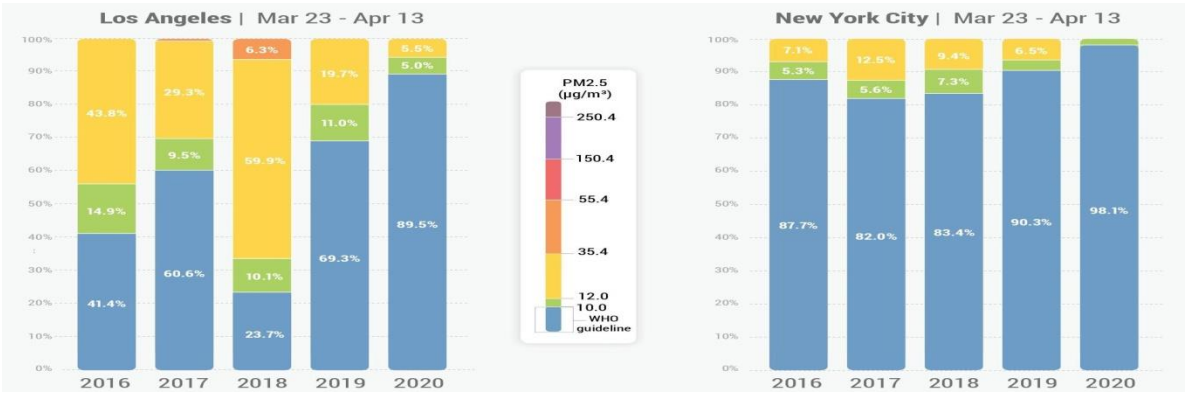
During Los Angeles's defined 3-week lockdown period, PM2.5 concentration levels are down by 31% from the same time last year, and down 51% from the average of the prior 4 years.

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.
ISSN (electronic): 2620-6269/ ISSN (printed): 2615-4021



Graph 9: Daily PM2.5 levels in Los Angeles from 2016-2020, during the 2020 lockdown period (Mar 23 - Apr 13)

In Los Angeles during this lockdown period, 90% of hours met the WHO target for PM2.5, while 95% of hours met the US 'good' category (up from 70% and 81% in 2019). In New York, 98% of hours met WHO targets for PM2.5 in 2020, while 100% of hours were in the best US AQI "Good" category (up from 94% in 2019). A handful of hours have observed PM2.5 levels below 1.3 µg/m³ (or AQI 5), an extremely rare event.



Graph 10: Los Angeles and New York City's distribution of hourly PM2.5 concentrations from Mar 23 - Apr 13, shown as US Air Quality Index categories

DATA ANLAYSIS OF EUROPE

Results showed that London and Madrid's average PM2.5 levels reduced by 9% and 11% respectively, since 2019

LOCKDOWN MEASURES

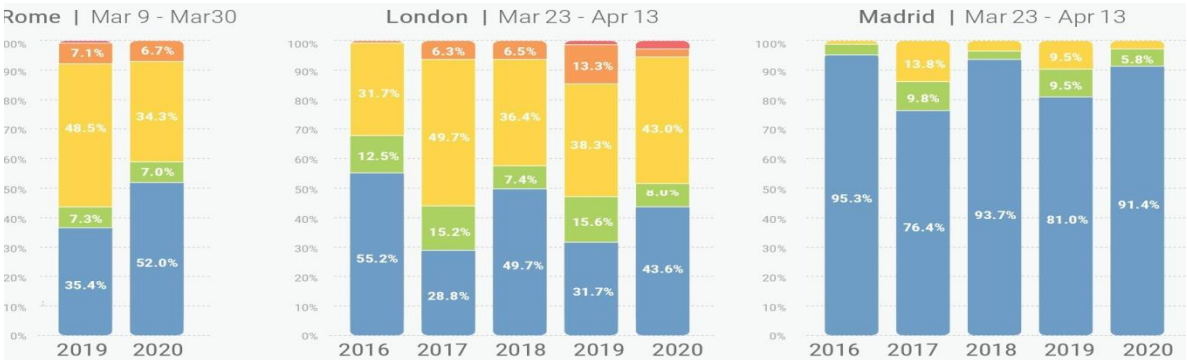
As the pandemic spreads within Europe, Italy was the first country to announce a lockdown on non essential movement, first in the North of Italy on March 10, then nationwide on March 12 in response to growing cases around the country. 1 Spain followed soon after only for essential trips.2 The lockdown rules were extended March 30 to order the closure; with the government introducing confinement rules on March 14 allowing citizens to leave the home only only for essential trips.2 The lockdown rules were extended March 30 to order the closure of all businesses not providing key services during the pandemic.3 The UK followed on March 23 when Prime Minister Boris Johnson announced a lockdown prohibiting non-essential trips, aside from shopping, dealing with health issues, commuting where necessary and exercise. 4 People were instructed to work from home wherever possible. In most European countries, social distancing has been mandated, and large numbers of businesses closed

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.
ISSN (electronic): 2620-6269/ ISSN (printed): 2615-4021 . Hosting by Research Parks

IMPACT ON PM2.5

London and Madrid experienced reductions in PM2.5 of 9% and 11% respectively, during their lockdown periods compared to 2019 levels, despite an increase of hours which met the WHO guidelines 5,6 Rome conversely observed a 30% increase in particle pollution as compared to 2019 levels, despite an increase of hours which met the WHO guideline (<10μg/m³).7 Domestic heating is a significant source of air pollution in Rome from November 1 to April 15.7 Increased reliance on residential heating systems, coupled with cool air inversions that trap particulate pollution in the atmosphere, may e-x plain PM2.5 gains in the city as compared to 2019.

Comparing London and Madrid's PM2.5 levels during the 2020 lockdowns to the average of the prior 4 years doesn't show such a clear downward trend as in comparison to last year alone. Weather conditions and geographical location can greatly influence measured air quality, even after emissions fall. More data quantifying the changing levels of PM2.5 as these cities' lockdown periods continue will be beneficial to gain a more through comparison with previous years and clearer understanding of long term trends.



Graph 11: Rome, London and Madrid's distribution of hourly PM2.5 concentrations

(**Source:** 1. https://www.nytimes.com/interactive/2020/04/05/world/europe/italy-coronavirus-lockdown-reopen.html 2https://www.theguardian.com/world/2020/apr/06/europe-looks-past-lockdowns-as-us-and-japan-brace-for-coronavirus-trauma 3 https://www.thelocal.es/20200403/when-and-how-will-spains-lockdown-measures-end 4 https://www.telegraph.co.uk/news/2020/04/11/uk-coronavirus-lockdown-government-rules-extended 7https://www.sciencedirect.com/science/article/pii/S1876610217337773)

SUMMARY

9 of 10 key global cities experienced PM2.5 reductions from the same period in 2019 • Cities with historically higher levels of PM2.5 pollution witnessed the most substantial drops, including Delhi (-60%), Seoul (-54%) and Wuhan (-44%) • During Wuhan's 10-week lockdown, the city experienced its cleanest February and March air quality on record • Delhi's 'unhealthy' and worse rated hours plummeted from 68% in 2019 to 17% during the lockdown period1 • Los Angeles experienced its longest stretch of clean air on record meeting the WHO air quality guidelines.

City	Average PM2.5 during lockdown 2020 (μg/m³)	Reduction compared to 2019	Reduction compared with prior 4 year average	3-week lockdown dates, 2020
Delhi, India	32.8	-60%	-55%	Mar 23 - Apr 13
London, UK	16.2	-9%	+6%	Mar 23 - Apr 13
Los Angeles, US	5.5	-31%	-51%	Mar 23 - Apr 13
Madrid, Spain	6.4	-11%	+2%	Mar 23 - Apr 13
Mumbai, India	28.8	-34%	-43%	Mar 23 - Apr 13
New York City, US	4.4	-25%	-29%	Mar 23 - Apr 13
Rome, Italy	16.7	+30%	No data available	Mar 9 - Mar 30
São Paulo, Brazil	10.1	-32%	-26%**	Mar 23 - Apr 13
Seoul, South Korea	24.1	-54%	-32%	Feb 26 - Mar 18
Wuhan, China	35.1	-44%	-50%	3 Feb - Feb 24

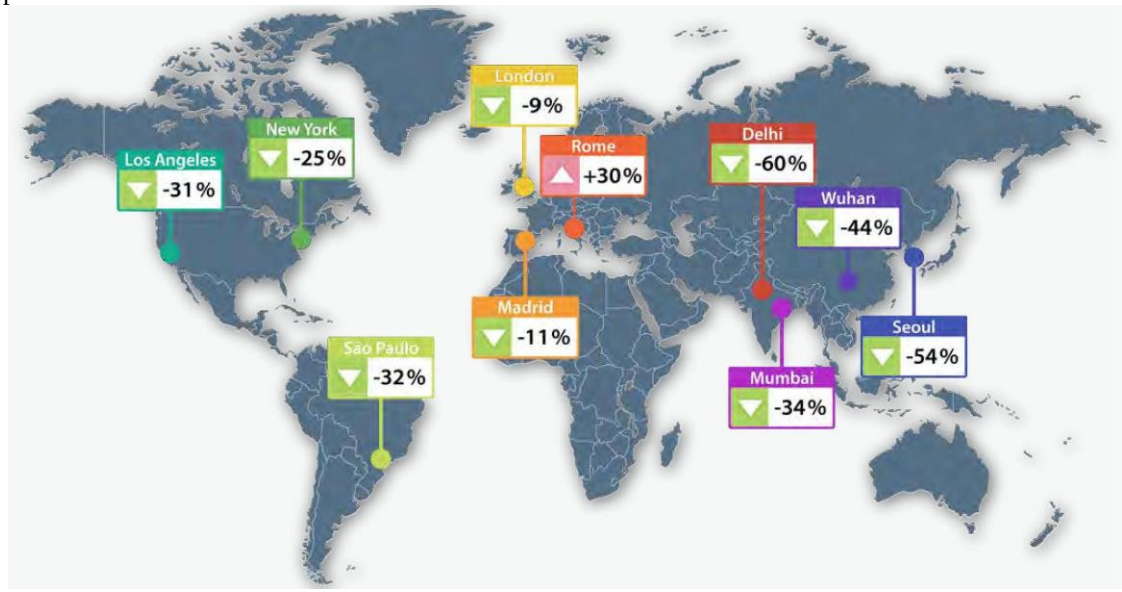
** Data for São Paulo is based on a 3-year average, rather than a 4-year average

(**Source:** US Air Quality Index)

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.
ISSN (electronic): 2620-6269/ ISSN (printed): 2615-4021

GLOBAL FINDINGS

Global Findings 9 of 10 key global cities experienced PM2.5 reductions from the same period in 2019. Ten major global cities have been studied in this report for their relatively high number of corona virus cases and government-mandated COVID-19 lockdown measures. In 7 of these identified cities, drastic restrictions on people's movement and economic activity imposed during lockdowns resulted in PM2.5 reductions of 25-60%, as compared to the same time period last year.1 Map 1: Percent reduction in PM2.5 levels when comparing 2020 lockdown period to the same period in 2019.



Map 1: Percent reduction in PM2.5 levels when comparing 2020 lockdown period to the same period in 2019

(**Source:** https://www.iqair.com/blog/air-quality/pm2-5)

CONCLUSION

The study finds that PM2.5 is a significantly decreased during the lockdown period due to COVID-19 incidence in various cities. The findings call for further investigation. In particular, the air pollution link should be investigated in multiple countries and for wider ranges of PM2.5 concentrations. If the relationship extrapolates to higher concentrations, the implications for developing countries may be severe. In particular, developing countries are highly polluted compared to the levels observed in this study.

REFERENCES

- *Bhattacharjee, S. (2020). Statistical investigation of relationship between spread of coronavirus disease (COVID-19) and environmental factors based on study of four mostly affected places of China and five mostly affected places of Italy. arXiv:2003.11277 [q-bio.PE].*
- *Chen, G., W, Z., S, L., Y, Z., G, W., R, H., H, R., W, C., and Y, G. (2017a). The impact of ambient fine particles on influenza transmission and the modification effects of temperature in China : A multi-city study. Environment International, 98:82–88.*
- *Chen, G., Zhang, W., Li, S., Williams, G., Liu, C., Morgan, G. G., Jaakkola, J. J., and Guo, Y. (2017b). Is short-term exposure to ambient fine particles associated with measles incidence in China? A multi-city study. Environmental Research, 156:306–311.*
- *Chen, Y. C., Huang, L. M., Chan, C. C., Su, C. P., Chang, S. C., Chang, Y. Y., Chen, M. L., Hung, C. C., Chen, W. J., Lin, F. Y., Lee, Y. T., Chen, D. S., Lee, Y. T., Teng, C. M., Yang, P. C., Ho, H. N., Chen, P. J., Chang, M. F., Wang, J. T., Kao, C. L., Wang, W. K., Hsiao, C. H., and Hsueh, P. R. (2004). SARS in Hospital Emergency Room. Emerging Infectious Diseases, 10(5):782–788.*
- *Guo, Z.-D., Wang, Z.-Y., Zhang, S.-F., Li, X., Li, L., Li, C., Cui, Y., Fu, R.-B., Dong, Y.-Z., Chi, X.-Y., Zhang, M.-Y., Liu, K., Cao, C., Liu, B., Zhang, K., Gao, Y.-W., Lu, B., and Chen, W. (2020). Aerosol and Surface Distribution of Severe Acute Respiratory Syndrome Coronavirus 2 in Hospital Wards, Wuhan, China, 2020. Emerging infectious diseases, 26(7).*
- *Onufrio, G. (2020). Inquinamento dell'aria e pandemia da Covid-19: che relazione c''e?*
- *Peng, L., Zhao, X., Tao, Y., Mi, S., Huang, J., and Zhang, Q. (2020). The effects of air pollution and meteorological factors on measles cases in Lanzhou, China. Environmental Science and Pollution Research, pages 1–10.*
- *Sajadi, M. M., Habibzadeh, P., Vintzileos, A., Shokouhi, S., Miralles-Wilhelm, F., and Amoroso, A. (2020). Temperature and Latitude Analysis to Predict Potential Spread and Seasonality for COVID-19. SSRN Electronic Journal.*

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.
ISSN (electronic): 2620-6269/ ISSN (printed): 2615-4021 .

- *Setti, L., Passarini, F., de Gennaro, G., Di Gilio, A., Palmisani, J., Buono, P., Fornari, G., Perrone, G., Piazzalunga, A., Barbieri, P., Rizzo, E., and Miani, A. (2020). Relazione circa l'effetto dell'inquinamento da particolato atmosferico e la diffusione di virus nella popolazione.*
- *van Donkelaar, A., Martin, R. V., Brauer, M., Hsu, N. C., Kahn, R. A., Levy, R. C., Lyapustin, A., Sayer, A. M., and Winker, D. M. (2016). Global Estimates of Fine Particulate Matter using a Combined Geophysical-Statistical Method with Information from Satellites, Models, and Monitors. Environmental Science & Technology, 50(7):3762– 3772.*
- *van Doremalen, N., Bushmaker, T., Morris, D. H., Holbrook, M. G., Gamble, A., Williamson, B. N., Tamin, A., Harcourt, J. L., Thornburg, N. J., Gerber, S. I., Lloyd-Smith, J. O., de Wit, E., and Munster, V. J. (2020). Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. The New England journal of medicine, page NEJMc2004973.*
- *Wu, A., Peng, Y., Huang, B., Ding, X., Wang, X., Niu, P., Meng, J., Zhu, Z., Zhang, Z., Wang, J., Sheng, J., Quan, L., Xia, Z., Tan, W., Cheng, G., and Jiang, T. (2020a). Genome Composition and Divergence of the Novel Coronavirus (2019-nCoV) Originating in China. Cell Host and Microbe, 27(3):325–328.*
- *https://www.airnow.gov/aqi/aqi-basics/*
- *https://www.who.int/airpollution/publications/aqg2005/en/*
- *The US AQI designation for PM2.5 concentration levels between 55.0 µg/m³ and 150.4 µg/m³*
- *The US AQI designation for PM2.5 concentration levels between 150.4 µg/m³ and 250.4 µg/m³.*
- *https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health*

E-mail address: info@researchparks.org
Peer review under responsibility of Emil Kaburuan.
ISSN (electronic): 2620-6269/ ISSN (printed): 2615-4021